AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION

Auditory Integration Training

Working Group in AIT

This technical report was prepared by the American Speech-Language-Hearing Association (ASHA) Working Group on Auditory Integration Training and was adopted by the ASHA Executive Board in March 2003. It supersedes the technical report, "Auditory Integration Training," 1994. Members of the Working Group were Anne Marie Tharpe (chair), Candace Bourland-Hicks, Judy Gravel, Jane Madell, Maurice H. Miller (coordinating committee member), and Gail Linn (ex officio). Richard Nodar and Susan J. Brannen, ASHA vice presidents for professional practices, served as monitoring vice presidents.

Over the past decade, audiologists, speech-language pathologists, and others have debated the contribution of auditory integration training (AIT), also known as auditory enhancement training and audio-psycho-phonology (ASHA, 1994; Friel-Patti, 1994; Gravel, 1994; Miller & Lucker, 1997; Rimland & Edelson, 1994; Veale, 1994). Initial anecdotal reports suggested that AIT, when used with individuals having diagnoses of autism, pervasive developmental disorders, learning difficulties, attention deficit disorder, and dyslexia, resulted in reduced hyperacusis, increased attention span, better eye contact, more social awareness, fewer tantrums, increased verbalizations, improved auditory comprehension, and improved articulation.

As a result of those reports, in 1994 the American Speech-Language-Hearing Association (ASHA) Subcommittee on Auditory Integration Training of the Ad Hoc Committee on Auditory Integration and Facilitated Communication published a report that reviewed the existing data on AIT. At that time, because the primary data sources were nonrefereed journals and anecdotal reports, the committee recommended that AIT be considered an experimental treatment and that consumers be notified of such before receiving services (ASHA, 1994).

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Almost 10 years have passed since the writing of that report. The 2002 committee reviewed the extant research literature on AIT and concluded that a sufficient amount of data existed to warrant an update of the 1994 report. At the time of this writing (2002), there are approximately 250 practitioners of Berard-type AIT in the United States and Canada (Autism Research Institute, personal communication, July 1999). Although practitioners include psychologists, physicians, social workers, and teachers (among others), the majority of practitioners are speech-language pathologists or audiologists.

AIT Methodology

Although at least three AIT[1] methods currently exist, the Berard method has emerged as the most commonly used in the United States and has been described most often in professional literature. For those reasons, the Berard methodology will be emphasized in this report. Although some practitioners of the Berard methodology have modified his proposed procedures to varying degrees, his original methods, as described in his book (Berard, 1993), are the focus of this review. For those interested in obtaining additional information on other methods of AIT, including the Tomatis and Clark methods, several reviews are available (ASHA, 1994; Gilmore, Madaule, & Thompson, 1989; Kershner, Cummings, Clarke, Hadfield, & Kershner, 1990; Madaule, 1993).

Treatment

The Berard method of AIT was first publicized in this country in the book *Sound of a Miracle,* which described a case of childhood autism reportedly cured following AIT treatment (Stehli, 1991). Dr. Guy Berard, an otolaryngologist in France, developed a method of AIT based on the premise that certain people have hypersensitive hearing at selected frequencies and that this can cause agitation, pain, and interference with learning. Berard has explained

[1] Although many techniques for auditory sensitivity training are quite similar, some differ significantly in terms of theory and technique and are not generally termed AIT. For purposes of this report, however, all methodologies discussed herein are referred to as AIT.

that even in the absence of hypersensitive hearing, people can present with audiograms that have "peaks" and "valleys," that is, thresholds for adjacent audiometric frequencies that differ by 5 dB or more and result in atypical perception of sounds. In his book, *Hearing Equals Behavior*, Berard (1993) theorizes that these auditory distortions may result in such behavioral disturbances as autism spectrum disorders, learning disabilities, depression, and aggressiveness. Berard suggests that AIT treats these distortions by exercising the middle ear muscles and auditory nervous system in much the same way that muscles are retrained in physical therapy for an injured elbow (Berard, 1993, pp. 78–80). An audiogram, frequently the first step in the Berard method of AIT, is believed to help identify the presence of the auditory "abnormalities" (Berard, 1993, pp. 61–76) and is used to monitor possible changes as a result of treatment. Berard claims that following AIT, children's audiograms that previously had peaks and valleys, demonstrating areas of hyper- and hyposensitivity, are "flattened," reflecting the elimination of auditory distortions and, subsequently, an improvement in behavioral abnormalities. The validity of defining these "peaks and valleys" as auditory abnormalities has been questioned elsewhere (Gravel, 1994; Miller & Lucker, 1997; Tharpe, 1998, 1999).

According to Berard (1995), optimal treatment consists of two half-hour sessions per day separated by a minimum of 3 hours, for 10 consecutive working days. A 2-day weekend interruption is acceptable. Despite current practice in the United States, Berard does not recommend follow-up sessions or any modifications to this treatment regimen. Results are evaluated by reviewing the audiogram obtained at the end of the 20 sessions and behavior changes at other post-treatment intervals.

Candidacy

The Berard method has been recommended for people with learning disabilities, behavior disorders, autism, pervasive developmental disorder, attention deficit disorder, attention deficit hyperactivity disorder, tinnitus, progressive deafness, and hyperacusis (Berard, 1993; Georgiana Institute, personal communication, January 2000; Veale, 1994; Yencer, 1998). In addition, those with allergic disorders, depression, suicidal tendencies, poor organizational skills, foreign accents, and writer's block have been viewed as potential beneficiaries of this treatment, although apparently not targeted as potential candidates in the United States (ASHA, 1994; Berard, 1993). More information on the Berard method of AIT can be obtained in Berard (1993) and Rimland and Edelson (1994).

Equipment

Traditionally, treatment has been conducted with a device Berard designed called the Ears Education and Retraining System (EERS) or the Audiokinetron. The machine's frequency response has been reported to be 30 to 15,000 Hz, with eight band-reject filters centered at .75, 1.0, 1.5, 2.0, 3.0, 4.0, 6.0, and 8.0 kHz available for adjustment (Berard, 1993; Rankovic, Rabinowitz, & Lof, 1996). Each filter is one octave wide, with a maximum nominal band attenuation of 40 dB. Music is presented via compact disc (CD) players, LP records, or tapes, and the amplitude is modulated randomly at a rate of 0.5 to 4 Hz. Using musical input that contains very broad frequency stimulation, this device randomly switches between low- and high-pass filtering for periods of 250 ms to 2 sec, a process that also results in variable intensity, thus creating a modulated effect (Berard, 1993; Rankovic, Rabinowitz, & Lof, 1996; Rimland & Edelson, 1995). The purpose of this modulation is to prevent the listener from predicting or becoming used to the pattern of presentation (Berard, 1993). In addition, a maximum of two filters may be set to attenuate the frequencies where hypersensitive hearing is believed to occur. Audiograms are repeated at midpoint in the treatment to determine if filter settings need to be changed. Output transducers are circumaural headphones. Rankovic and colleagues (1996) reported an average overall intensity level of 118 dB SPL for the maximum output setting and 110 dB SPL for the highest-use setting. Volume control can be adjusted independently for each ear but the band-reject filters cannot (Georgiana Organization, personal communication, 1994; Rankovic, Rabinowitz, & Lof, 1996). It should be noted that calibration equipment for those wishing to make independent measures has not been available.

Because of difficulties in importing the Audiokinetron, other auditory training programs that use compact discs (CDs) without specialized equipment have gained popularity over the past several years. Some of these programs can be administered in the client's home. EARliest Adventures in Sound (now Peak Performance Group) designed a system called Digital Auditory Aerobics (DAA) that consists of 20 30-minute CDs, each containing randomly modulated music with a wide frequency spectrum. Played through circumaural earphones, the modulation of the music on each CD is reportedly an exact replication of the output produced by Berard's Audiokinetron. The DAA also allows for filtering specific frequencies by decreasing intensity approximately 50%. A different volume setting for each ear can be obtained (EARliest Adventures in Sound, LLC, personal communication, December 1999).

In addition, the Samonas Sound Therapy uses classical music on CDs, and its proponents claim that listening to their music can "improve psychological and physiological conditions such as hearing, learning difficulties, voice problems, and behavioral disturbances…" (retrieved February 7, 2000, from www.ist@sonas.com). Equipment requirements include only a portable CD player and Sennheiser HD500A headphones. This program reports that it is based on the work of Alfred Tomatis (see ASHA, 1994).

The Listening Program, another auditory therapy, is distributed through Advanced Brain and consists of reproduced music that has been filtered on CDs. The CDs come in sets of eight, and clients are typically advised to listen to one CD per week at home (Advanced Brain, personal communication, February 6, 2000).

Federal Regulation of Equipment

To date, no AIT device has been approved by the FDA for marketing as a medical device in the United States. This means that a manufacturer cannot promote AIT equipment as a device that is intended for the cure, mitigation, or treatment of a disease or a condition such as autism, attention deficit disorder, or other physical or mental condition. The FDA position is that if the Audiokinetron is used solely as an aid to education, it is not considered a medical device and not subject to FDA regulation (Society for Auditory Integration Training, 2000).

Practitioner Education

At the time of this writing, training is not required for the administration of DAA, the system that has replaced the Audiokinetron in the U.S. (Georgiana Organization, personal communication, September 22, 2000). Included with the purchase of the DAA system is a manual that explains the administration of the therapy (EARliest Adventures in Sound, LLC, personal communication, March 2000).

Two-and-a-half day training sessions are offered to practitioners of the Listening Program. They are also trained to identify individuals in need of auditory retraining.

Those seeking training as practitioners of Samonas Sound Therapy must meet one of four prerequisites before attending the practitioner training workshop. These prerequisites include (1) previous attendance at other workshops offered by the providers of the training, (2) previous training as a Berard or Tomatis practitioner, (3) study of the book *Samonas Sound Therapy* (Steinback, 1998), or (4) completion of a written case study using Samonas with a client or oneself. After completing one of the initial workshops, the practitioner is authorized to purchase treatment discs of therapeutic music for use in home and clinic programs. Advanced training consists of a one-week workshop. The credentialing process is completed after a year of practice using all levels of the treatment discs and written documentation of theoretical and clinical concepts (Samonas International, personal communication, August 2000).

Concerns Related to Current Practice

Research Findings

Prior to the 1994 ASHA report, there was little supporting scientific evidence published in refereed journals regarding the treatment efficacy of AIT (Friel-Patti, 1994; Gravel, 1994). That is not unusual when a new treatment is introduced and time has not yet permitted careful study. At that time, the ASHA Subcommittee on AIT relied heavily on anecdotal and nonpublished clinical reports for information. Several authors have warned of the problems associated with interpretation of research that has not incorporated safeguards against contamination by the placebo effect, regression to the mean, and other influences (Gravel, 1994; Miller, 1996; Roberts, Kewman, Mercier, & Hovell, 1993; Tharpe, 1998, 1999). Nearly a decade has passed since AIT was first practiced in this country, and more studies have appeared in the professional literature. Therefore, it is reasonable to limit this current literature review to peer-reviewed, data-based reports of research in the area of AIT. Although the reader is referred to a number of anecdotal and nonrefereed reports (Fox, 1992; Madell, 1993a, 1993b; Rimland & Edelson, 1991, 1992; Veale, 1993), these articles will not be reviewed in this document. It should also be noted that this research review is limited to Berard methodology because no publications on the other methods of AIT could be located in refereed journals.

A study frequently cited as support for AIT was published in 1994 by AIT proponents Bernard Rimland and Stephen Edelson. This study included 445 adults and children with a primary or secondary diagnosis of autism. The subjects were all treated with the Berard method of AIT, but three different devices were used to provide the modulated music. The investigators were interested in answering the following questions: (a) Does AIT reduce sensitivity to sounds? (b) Is it helpful to use filters (versus no filters) during the AIT listening sessions? (c) Is there a profile that predicts the best candidates for AIT? (d) Are the three different AIT devices equally effective? Dependent variables assessed included the results of audiograms (before, at the midpoint, and after the completion of treatment), loudness discomfort tests, and parent questionnaires. The authors concluded that there were no differences in test results across the three devices or if filtered versus no-filter conditions were used. A reduction in problem behaviors reported by parents between pre- and post-AIT was noted. However, as the investigators themselves acknowledge, the lack of an appropriate control group was "a serious limitation" (Rimland & Edelson, 1994, p. 18). Similarly, although the authors did report statistically significant improvement in the subjects' hearing from the first to the second hearing test, no control group was employed. Therefore, we do not know if the treatment contributed to the changes noted in auditory thresholds. Also, the statistically significant changes in the subjects' thresholds were less than 1 dB, thus having no functional significance.

In 1995, Rimland and Edelson reported the results of a pilot study of AIT effectiveness in a group of 17 children and young adults with autism (ages 4–21 years). Using a matched-pairs design, eight experimental subjects received

traditional AIT and seven subjects (one subject dropped out of the study) listened to the same music that was not filtered or modulated. Based on two parental questionnaires of adaptive behavior, the authors concluded that the experimental group exhibited significantly fewer aberrant behaviors 3 months following treatment than subjects in the control group. It is important to note, however, that an analysis of pretreatment data also revealed significant differences between groups on these measures. That is, the integrity of the control group was violated. The authors attempted to compensate for this error by using difference scores reflecting the amount of change since the baseline assessment for the analyses. This process is questionable, however, because the experimental group started out so much poorer on these measures than did the control group. No differences between groups were found in measures of post-treatment pure tone sensitivity, pure tone discomfort levels, or parental rating of hearing sensitivity.

In 1996, Bettison published findings in support of AIT for use with children (N= 80) diagnosed with autism, significant autistic symptoms, or Asperger syndrome. Dependent variables assessed included results of a number of behavioral checklists completed by the subjects' teachers and parents, and audiometric measures that were administered before treatment and at 1, 3, 6, and 12 months after treatment. Two subject groups were used: an experimental group that received the Berard method of AIT and a placebo group that received the same treatment regimen with unmodulated music. There was no control (no treatment) group. No between-group differences were noted for any of the behavioral checklists or audiometric findings. These findings led Bettison (1996) to conclude that both the traditional Berard method of AIT and the use of unmodulated music (placebo) are effective interventions for children with autism spectrum disorders. Another interpretation would be that an effect other than a specific treatment effect (i.e., AIT) was responsible for the improvements. Without the use of a control group, that issue cannot be resolved.

Zollweg, Palm, and Vance (1997) examined the efficacy of AIT in a population of children and young adults (N= 30) with multiple handicaps. Although AIT is typically considered to be a treatment for individuals with autism spectrum disorders, such treatment has been recommended for those with other disorders (e.g., learning disabilities, attention deficit disorders, depression) (ASHA, 1994; Berard, 1993). Two study groups were used: an experimental group (N=15) that received AIT with modulated music and a placebo group (N=15) that received unmodulated music. All subjects were provided treatment by Berard-trained practitioners with the BGC device. Treatment effectiveness was determined by the results obtained on behavior rating scales, pure tone thresholds, and loudness discomfort levels obtained 4 weeks before treatment and at 1, 3, 6, and 9 months post-treatment. Zollweg and colleagues (1997) found no significant differences in either group in pure tone thresholds or loudness discomfort levels following treatment. They observed a slight improvement in behavior for both groups, suggesting that a nontreatment effect was responsible for the behavioral improvement. Again, without the use of a control group (no treatment), it is difficult to determine whether or not the simple act of listening to music, modulated or unmodulated, or the attention given to these children in the therapeutic situation can explain the behavioral improvements noted in this study. The authors acknowledged that their small sample size and diverse subject population may have contributed to their negative findings.

More recently, Yencer (1998) evaluated the effectiveness of the Berard method of AIT utilizing BGC equipment in improving performance on behavioral tests of auditory processing, neural responses to auditory stimulation (auditory brainstem response and P300 event-related potential), and parental questionnaires about auditory problems. Thirty-six children diagnosed with central auditory processing disorders (CAPD) served as subjects. Three subject groups were employed in this design: an experimental group that received treatment, a placebo group exposed to unmodulated music, and a control group that received no treatment. All subjects were tested before the initiation of treatment and 7 weeks later (4 weeks following the end of treatment for the experimental and placebo groups). No differences among groups were reported, indicating that AIT is no more beneficial for children with CAPD than listening to regular, unmodulated music or receiving no treatment at all.

Finally, Edelson et al. (1999) used the Berard method of AIT with BGC equipment with children and adults diagnosed with autism (N=19). Three behavior questionnaires were completed by parents before and once a month for 3 months following treatment. Pure tone threshold testing was attempted with subjects before treatment, after 5 hours of treatment, and 1 day following treatment. In addition, two central auditory processing tasks and P300 evoked potentials were obtained 1 month before and 3 months following AIT. Subjects were randomly assigned to two groups: the experimental group received traditional Berard AIT with modulated music, and the placebo group listened to the same music without modulation on the same schedule as the experimental group. No control group was used. No frequency filters were set for either group. Parents and examiners were blind as to each child's group assignment until completion of the study. Audiometric results were not analyzed because a sufficient number of subjects could not complete the tasks. The authors reported that improvements were noted in the P300 evoked potentials of subjects in the experimental group, but only three members of the experimental group and two members of the placebo group were able to perform the P300 task. In addition, no statistical analyses of the between-group dif-

ferences were reported. One of the behavior questionnaires yielded results suggesting a significant reduction in behavioral problems in the experimental group by the third month following the listening sessions.

In summary, this committee examined six studies of the effectiveness of AIT. Although numerous study limitations were noted, it is clear from this review that there is limited evidence in the scientific literature to support the notion that AIT improves the behavior of individuals who undergo this procedure.

Potential Treatment Risks

The committee believes it necessary to scrutinize practices such as AIT for several reasons. Parents of children with disorders for which there are limited treatment options may be receptive to therapies having limited or no scientific underpinnings, especially when those therapies are endorsed by enthusiastic practitioners with impressive credentials. Lack of empirical data to support the effectiveness of a treatment can be overlooked by parents who hear anecdotal reports of treatment success and claims of success by convinced practitioners. If parents continue to try ineffective treatment options, it is reasonable to think that at some point they will run out of hope, financial means, or both. Parents should explore other existing treatments that are based on sound scientific principles. When an effective treatment option becomes available, parents who have spent considerable money on various alternative treatments may be unwilling or unable to have their children participate. Therefore, ASHA supports the use of well-controlled, randomized clinical trials to control for placebo effects and determine the effectiveness and safety of AIT for specific populations.

Rankovic, Rabinowitz, and Lof (1996) examined the output of the Audiokinetron. Using a KEMAR manikin for measurement purposes, these investigators found that the average output levels at the eardrum were 110 dB SPL when the device was adjusted to the highest setting employed by a trained AIT practitioner and 118 dB SPL at the maximum setting of the device. Of particular concern is that children's ear canals are smaller than those of adults. As such, the sound levels measured in a 2-cm^3 coupler, as is used with KEMAR, underestimate the sound level arriving at the eardrum of a young child (Feigin, Kapun, Stelmachowicz, & Gorga, 1989). The Occupational Safety and Health Administration (U.S. Department of Labor, 1983) warns that adults who are exposed to noise levels at or above 85 dBA for an 8-hour time-weighted average are at risk for noise-induced hearing loss; the acceptable exposure time decreases dramatically as the intensity of the sound increases. For example, the maximum allowable exposure levels for occupational noise are 90 dBA for 8 hours, 110 dBA for 30 minutes, and 125 dBA for less than 4 minutes (ASHA, 1991). Limited data are available regarding damage risk criteria for children. However, it is reasonable to assume, based on smaller ear canal volumes (Feigin et al., 1989), that children will be at an even greater risk than adults when exposed to high-level noise. Thus, a more stringent criterion for acceptable exposure time is in order for children. Therefore, the output levels of the Audiokinetron are likely to exceed those reported by Rankovic and colleagues in the ear canals of children. Detailed calibration information is not available on the DAA, although it has been reported that the music output of the DAA is "an exact replication of the output produced by the Audiokinetron" (EARliest Adventures in Sound, LLC, personal communication, December 1999).

The following concerns remain unresolved:

- No evidence-based guidelines regarding candidacy selection are available.
- No preponderance of evidence exists documenting treatment effectiveness.
- Considerable variety exists in protocols for the administration of AIT.
- Limited specifications are available from the manufacturers of AIT equipment, resulting in concern about the potential for excessive noise levels especially in young children.

Summary and Recommendations

This report has reviewed the method of AIT most commonly used in the U.S. and offered as treatment for a variety of communication, behavioral, emotional, and learning disorders. Despite approximately one decade of practice in this country, this method has not met scientific standards for efficacy and safety that would justify its inclusion as a mainstream treatment for these disorders. The American Academy of Audiology (1993), ASHA (1994), the American Academy of Pediatrics (1998), and the Educational Audiology Association (1997) all concur that AIT should be considered an experimental procedure. In addition, more recently, the New York State Department of Health (1999) developed clinical practice guidelines for the assessment of and intervention for children with autism and pervasive developmental disorders. After evaluation of the research currently available on AIT, the New York Department of Health concluded that the efficacy of the treatment had not been demonstrated and recommended that AIT not be used as an intervention for young children with autism. Nonetheless, this therapy continues to be offered as a clinical treatment by some audiologists, speech-language pathologists, and others. Thus, as a result of the review of AIT research literature reported herein, it is recommended that ASHA re-examine this report should scientific, controlled studies supporting AIT's effectiveness and safety become available.

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Resources

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The Listening Program
P.O. Box 1088
Ogden, UT 84402
Tel: 801-622-5676

BGC Enterprises, Inc. (Distributor/Sales)
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SAPP (Audiokinetron manufacturer)
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